descended toward the earth. Then there was a few seconds of death-like calm, the thunder ceased. Soon, to the southwest was heard a deafening roar. The funnel-shaped cloud kept close to the surface and began its deadly work about one mile southwest of Gainesville, striking a large cotton mill at exactly 12:45 p. m., eastern time, just 10 minutes after 750 employees had filed into the great structure from dinner. Only the fourth and fifth floors of this building were injured by the wind, although the entire structure was damaged by the heavy downpour of rain. On the top floor of the mill were employed 250 children, and it was here that the greatest loss of life occurred. The force of the wind tore the roof and top story off and hurled giant timbers and massive blocks of marble for a distance of more than a hundred feet. Children employed in the spinning room were hurled to the ground and instantly killed. Only two or three bodies were found inside the building, the rest were buried in the débris in front of the building. The fifth floor of the mill fell forward in the direction of the storm's progress, while the rear end remained almost intact, the floor slanting at an angle of about 45°. For half a mile to the southwest of the mill trees were blown down and a few outhouses wrecked, but no great damage was done. The village of the mill where most of the employees live, in 80 of the company's houses, was absolutely unharmed by the storm. This is due to the fact that this village stood on a high hill above the mill.

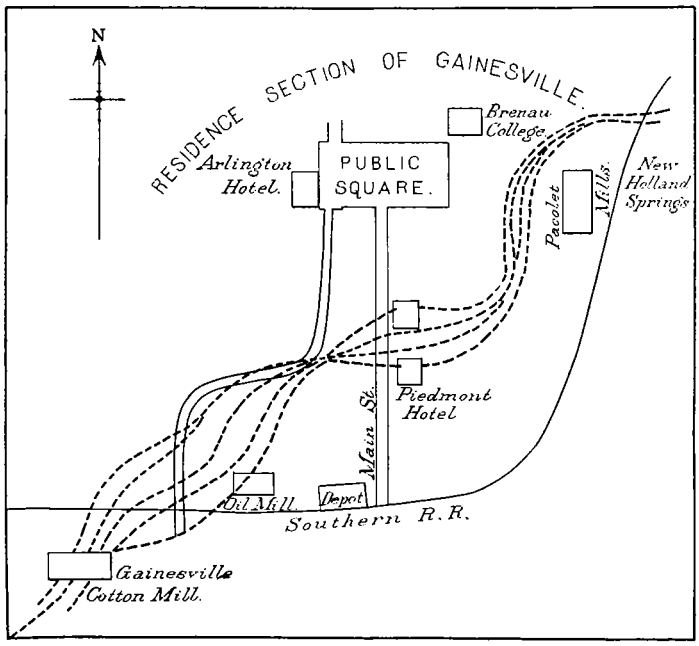

FIG. 1.—Path of the storm.

The walls of the mill fell outward and the roof was lifted into the air and held suspended for several seconds, showing that a decided vacuum was formed just over the doomed building.

The people in the building had no opportunity to prepare for the great danger. Clouds overhung the sky most of the morning, but they looked like many other rain clouds they had seen, and no special attention was paid to them. With a roar and a rush sounding like "a hundred express trains" the storm came down upon the unsuspecting victims with all its maddening fury. The fury of the gale lasted only a few seconds, when the air became as quiet and still as death for a few moments. Then the rain came down in torrents, accompanied by vivid lightning and wild rolls of thunder. During this time the rescuers worked among the débris.

In the rear of the mill was an immense standpipe, fully 50 feet off the ground and about 50 feet tall in itself. This standpipe was about 40 feet in diameter and was covered with an immense sheet iron cupola. This great cupola, weighing several tons, was lifted bodily from the top of the standpipe, carried high into the air, and dropped about a hundred feet in front of the mill, killing several persons who had thus far escaped danger. With the exception of the loss of the cupola, the great standpipe was uninjured. A brick chimney 125 feet high and directly in the path of the storm was uninjured.

The next building in the path of the storm was the Gainesville Iron Works, which was badly damaged; the roof was blown off and the walls thrown out of plumb, but no lives were lost, as no one was in the building at the time.

The storm then jumped across the tracks of the Southern Railway Company, destroying the switch signals and targets and all telegraph and telephone poles along its track. Freight cars standing on the side tracks were taken up bodily and thrown against a near embankment. In some instances cars were lifted from the trucks and carried some distance away; others were carried away trucks and all. Huge pieces of timber and logs were carried along with frightful velocity.

When the storm first crossed the railroad tracks it seemed heading directly toward the center of the city, half a mile distant, but it swerved to the east, cutting a path from 200 to 300 yards wide, until it struck the mill village of New Holland, 2 miles northeast of the Gainesville depot. At New Holland, where is located the Pacolet Mills, one of the largest cotton manufacturing plants in the South, the course of the storm turned and the mill was but little damaged, but the village of cottages, where lived the 1300 employees, was almost entirely destroyed. Out of 120 cottages about 70 were totally wrecked. Hundreds were at work in the mill and were saved, but a large number, especially the aged women and small children, were in the cottages and many were killed. It is estimated that at least $100,000 damage was done goods and machinery at this mill.

After leaving New Holland the fury of the storm lessened so rapidly that, beyond a few fences and small trees being blown down, no damage was done. The entire track of the tornado was about 4 miles. In all, 98 persons were killed, nearly double that number injured, while the money value of the property loss amounted to about $1,000,000.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITTIER, Director, Physical Geographic Institute.
[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the weather showed no marked abnormalities. Rain was moderate although slightly above the normal. At San José pressure, temperature, and relative humidity were very near to the means of the foregoing years of observation. Sunshine, 165 hours against the normal of 133 hours. On the Atlantic slope the rain was in excess, with intermediate weeks of drought at the coastal stations, while in the mountains the rainfall, also generally heavier than usual, was more continuous.

Notes on earthquakes.—June 24, 7h 14m a. m., slight shock NW–SE, intensity II, duration 3 seconds.

WEATHER REPORTS FROM VESSELS AT SEA.

By Prof. A. G. MCADIE, dated June 19, 1903.

In reply to an inquiry concerning the meteorological reports which were received daily from the cable ship *Silvertown* by the district forecaster at San Francisco during the time when the vessel was engaged in laying the American transpacific cable, the following brief article is submitted:

From December 14 until December 24, 1902, through the courtesy of Captain Morton of the steamer and Mr. H. Benest, Chief of the Cable Expedition, the weather conditions prevail-

ing at sea were transmitted daily to the Weather Bureau office at San Francisco. These were carefully plotted from day to day and were utilized with good results by the forecast official.

The Commercial Pacific Cable Company is now (June, 1903) laying nearly 10,000 nautical miles of cable across the Pacific Ocean. The cable is laid in sections running from San Francisco to Honolulu, from Honolulu to Midway, Midway to Guam, Guam to Manila, and from Manila to Shanghai. This will not be the first cable across the Pacific, making complete the circuit of the world for cabling purposes. The British Pacific cable running from Victoria to Fanning Island, to Fiji, to Norfolk, to Southport and to Doubtless Bay, was completed October 31, 1902. The line was opened for commercial business during the first decade of December, 1902. The length of the British Pacific cable is 7900 nautical miles. A detailed description of the laying of the American transpacific cable is given by the writer in the Journal of Electricity, Power, and Gas, San Francisco, Cal., January, 1903.

Through the courtesy of Mr. Clarence H. Mackay and Mr. Geo. H. Ward the Weather Bureau office at San Francisco was enabled to test the value of weather reports from the Pacific Ocean. The following table gives the daily run of the ship and her position at noon, ship's time, when weather reports were cabled:

Date.	Position.		Total cable laid.	Soundings.
	Lat. N.	Long. W.		
1902.	° ′	° ′	*Miles.*	*Fathoms.*
December 15	37 8	123 47	77	1,800 Mud.
16	35 50	126 44	259	2,550 Yellow ooze.
17	34 36	129 59	455	2,700 Brown ooze.
18	33 14	133 30	662	2,685 Do.
19	31 39	136 46	865	2,550 Do.
20	30 18	139 38	1,054	2,480 Do.
21	28 44	143 2	1,269	2,725 Do.
22	27 7	146 16	1,480	2,820 Do.
23	25 39	149 8	1,677	2,880 Do.
24	23 57	151 20	1,894	3,016 Do.
25	22 22	155 23	2,109	2,426 Do.
26	21 18	157 50	2,238	450 Do.
	Honolulu *			

Connections at Honolulu, 38 miles; in all, 2276.317 nautical miles.

* Hawaiian standard time is based on standard meridian, 157° 30′, or ten hours and thirty minutes west of Greenwich. Honolulu local mean time is ten hours and thirty-one minutes slow of Greenwich. San Francisco local mean time is three hours and ten minutes slow of Washington.

NOTE.—The United States Coast and Geodetic Survey is now sending a series of time signals over the cable for determining longitude of Honolulu. The exact time difference has doubtless been determined to a fraction of a second.

While the cable was being laid communication with the shore was restricted to one hour in every twenty-four, as a rule the hour beginning with the ship's noon. Insulation tests of the cable were made every five minutes. The first report from the *Silvertown* was received on December 15, when the vessel was about ninety miles off shore. An interesting fact is that the steamer was experiencing strong southeast winds with rain, while at San Francisco, ninety miles to the northwest,[1] the wind was northwest and weather cloudy. At Point Reyes Light, however, thirty-five miles northwest of San Francisco, the wind was southeast. The wind was also from the southeast at Mount Tamalpais. It appears then that at San Francisco there still existed a stream of air flowing near the surface of the earth from the great valley to the sea, while within comparatively short distances, both horizontally and vertically, air currents were moving at an angle of 90° with this. The wind at sea was southeast.[2] The second message received from the *Silvertown* indicated the existence of a disturbance off the coast of southern California, with strong northwest winds prevailing at sea. The pressure conditions shown on the forecast map a few hours later indicated the probable approach of a storm which would reach the coast south of Point Conception and move eastward across southern California and Arizona. Forecasts of *rain* for southern California and of *fair* weather for northern California were issued. By the morning of December 17 the rainfall at Los Angeles amounted to 1.34 inches; at San Diego, 1.72 inches. In northern California no rain fell.

The third message received from the steamer, December 17, while in 34° 36′ north and 129° 59′ west, indicated the passing of the disturbance at sea; terrific seas had prevailed all night of the 16th, followed by a heavy swell on the 17th, with partly cloudy weather. Conditions were still favorable for rain along the Mexican boundary, and forecasts were made in accordance therewith. All succeeding reports indicated fair weather for California.

We now know that at Honolulu the lowest pressure, 29.73 inches, occurred on December 10, and that a disturbance was then passing eastward over the Hawaiian Islands. It is also noticed that Mauna Kea and Mauna Loa were heavily covered with snow in the storm of the 11th to 13th. It may be inferred that the disturbance from the Hawaiian Islands moved slowly northeastward across the Pacific in six days, the average velocity being about fifteen miles an hour. It is of further interest to note that this disturbance apparently preserved its identity in crossing the United States. In the MONTHLY WEATHER REVIEW for December, 1902, on Chart II, "low" area marked "No. V" is doubtless the same disturbance which reached the Pacific coast near San Diego on December 16, 8 p. m. This disturbance is charted as leaving the United States near the mouth of the St. Lawrence on December 22. It would be interesting to know the further history of the disturbance.

[1] Northeast. (?)

[2] In the opinion of the district forecaster, the wind directions at San Francisco are largely influenced by the peculiar topography of the district.

THE EARTHQUAKE OF JUNE 2, 1903, AT WASHINGTON, D. C.

By C. F. MARVIN, Professor of Meteorology.

At $8^h\ 27^m\ 0^s$, June 2, 1903, the new Omori seismograph at the Central Office of the Weather Bureau began the registration of an earthquake which is the second one recorded since the apparatus was set up in February of this year. The disturbance was inappreciable to ordinary sensations, but it is evident from the record that at its origin it was undoubtedly of very considerable severity. It is also seen that the movement of the earth had traveled a long distance before reaching Washington.

The reader is referred to section *C* of fig. 1, page 126, of the March REVIEW for an illustration of an earthquake record by the Omori instrument. The present record, which is not reproduced, is very much longer and shows much more complex movements of the earth than in the earthquake of March 15. The following table gives the times of occurrence of the principal features of the record:

June 2, 1903, (75th meridian time).

	H.	*m.*	*s.*
First preliminary tremor	8	26	32
Second preliminary tremor	8	33	8
Principal portion began	8	43	2
Principal portion ended	8	48	49
Duration of the end portion	0	43	28
End of earthquake	9	32	16
Total duration	1	5	46

Maximum double amplitude of strong waves in the principal portion, 0.22 millimeter.
Period of the pendulum, 26 seconds.
Magnification of record, 10.

AUTUMNAL COLORATION OF FOLIAGE.[1]

By Mr. A. F. WOOD, Pathologist and Physicologist, Bureau Plant Industry, U. S. Department of Agriculture.

The production of color in autumn foliage is, as is well known, due in part to the gradual destruction of the chlorophyll when the leaves have reached maturity and approach the

[1] Advance copy from an article on Autumnal Coloration in the Encyclopedia of Horticulture.—ED.